

MOSFET – N-Channel, SUPERFET[®], FRFET[®]

600 V, 20 A, 190 mΩ

FCA20N60F

Description

SUPERFET MOSFET is onsemi's first generation of high voltage super-junction (SJ) MOSFET family that is utilizing charge balance technology for outstanding low on-resistance and lower gate charge performance. This technology is tailored to minimize conduction loss, provide superior switching performance, dv/dt rate and higher avalanche energy. Consequently, SUPERFET MOSFET is very suitable for the switching power applications such as PFC, server/telecom power, FPD TV power, ATX power and industrial power applications. SUPERFET FRFET MOSFET's optimized body diode reverse recovery performance can remove additional component and improve system reliability.

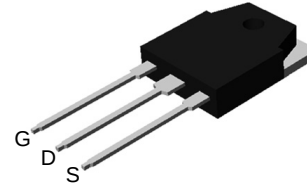
Features

- 650 V @ $T_J = 150^{\circ}\text{C}$
- Typ. $R_{DS(on)} = 150\text{ m}\Omega$
- Fast Recovery Time (Typ. $T_{rr} = 160\text{ ns}$)
- Ultra Low Gate Charge (Typ. $Q_g = 75\text{ nC}$)
- Low Effective Output Capacitance (Typ. $C_{oss(eff.)} = 165\text{ pF}$)
- 100% Avalanche Tested
- RoHS Compliant

Applications

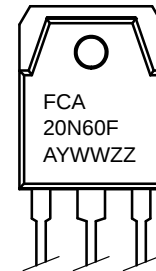
- LCD / LED / PDP TV
- Solar Inverter
- AC-DC Power Supply

V_{DSS}	$R_{DS(on)}\text{ MAX}$	$I_D\text{ MAX}$
600 V	190 mΩ @ 10 V	20 A



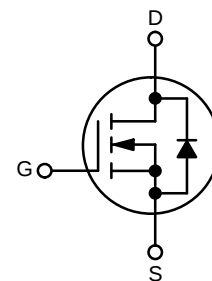
TO-3P-3LD / EIAJ SC-65, ISOLATED
CASE 340BZ

MARKING DIAGRAM



FCA20N60F = Specific Device Code
A = Assembly Location
YWW = Date Code (Year & Week)
ZZ = Assembly Lot

N-CHANNEL MOSFET



ORDERING INFORMATION

Part Number	Package	Shipping
FCA20N60F	TO-3P-3LD (Pb-Free)	450 Units / Tube

FCA20N60F

ABSOLUTE MAXIMUM RATINGS ($T_C = 25^\circ\text{C}$, unless otherwise noted)

Symbol	Parameter		FCA20N60F	Unit
V_{DSS}	Drain–Source Voltage		600	V
I_D	Drain Current	– Continuous ($T_C = 25^\circ\text{C}$)	20	A
		– Continuous ($T_C = 100^\circ\text{C}$)	12.5	
I_{DM}	Drain Current	– Pulsed (Note 1)	60	A
V_{GSS}	Gate–Source Voltage		± 30	V
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		690	mJ
I_{AR}	Avalanche Current (Note 1)		20	A
E_{AR}	Repetitive Avalanche Energy (Note 1)		20.8	mJ
dv/dt	Peak Diode Recovery dv/dt (Note 3)		50	V/ns
P_D	Power Dissipation	($T_C = 25^\circ\text{C}$)	208	W
		– Derate above 25°C	1.67	W/ $^\circ\text{C}$
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to $+150$	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds		300	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. Repetitive rating: pulse–width limited by maximum junction temperature.
2. $I_{AS} = 10$ A, $V_{DD} = 50$ V, $R_G = 25$ Ω , starting $T_J = 25^\circ\text{C}$.
3. $I_{SD} \leq 20$ A, $di/dt \leq 1200$ A/ μs , $V_{DD} \leq BV_{DSS}$, starting $T_J = 25^\circ\text{C}$.

THERMAL CHARACTERISTICS

Symbol	Parameter	FCA20N60F	Unit
$R_{\theta JC}$	Thermal Resistance, Junction–to–Case, Max.	0.6	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction–to–Ambient, Max.	40	$^\circ\text{C/W}$

FCA20N60F

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}, T_J = 25^\circ\text{C}$	600	–	–	V
		$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}, T_J = 150^\circ\text{C}$	–	650	–	
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C	–	0.6	–	V/ $^\circ\text{C}$
BV_{DSS}	Drain-Source Avalanche Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 20\text{ A}$	–	700	–	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 600\text{ V}, V_{GS} = 0\text{ V}$	–	–	10	μA
		$V_{DS} = 480\text{ V}, T_C = 125^\circ\text{C}$	–	–	100	
I_{GSSF}	Gate-Body Leakage Current, Forward	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$	–	–	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$	–	–	-100	nA

ON CHARACTERISTICS

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	3.0	–	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 10\text{ A}$	–	0.15	0.19	Ω
g_{FS}	Forward Transconductance	$V_{DS} = 40\text{ V}, I_D = 10\text{ A}$	–	17	–	S

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	–	2370	3080	pF
C_{oss}	Output Capacitance		–	1280	1665	pF
C_{rss}	Reverse Transfer Capacitance		–	95	–	pF
C_{oss}	Output Capacitance	$V_{DS} = 480\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$	–	65	85	pF
$C_{oss\text{ eff.}}$	Effective Output Capacitance	$V_{DS} = 0\text{ to }400\text{ V}, V_{GS} = 0\text{ V}$	–	165	–	pF

SWITCHING CHARACTERISTICS

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 300\text{ V}, I_D = 20\text{ A}, R_G = 25\text{ }\Omega$ (Note 4)	–	62	135	ns
t_r	Turn-On Rise Time		–	140	290	ns
$t_{d(off)}$	Turn-Off Delay Time		–	230	470	ns
t_f	Turn-Off Fall Time		–	65	140	ns
Q_g	Total Gate Charge	$V_{DS} = 480\text{ V}, I_D = 20\text{ A}, V_{GS} = 10\text{ V}$ (Note 4)	–	75	98	nC
Q_{gs}	Gate-Source Charge		–	13.5	18	nC
Q_{gd}	Gate-Drain Charge		–	36	–	nC

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Drain–Source Diode Forward Current		–	–	20	A
I _{SM}	Maximum Pulsed Drain–Source Diode Forward Current		–	–	60	A
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 20 A	–	–	1.4	V
t _{rr}	Reverse Recovery Time	V _{GS} = 0 V, I _S = 20 A, dI _F /dt = 100 A/μs	–	160	–	ns
Q _{rr}	Reverse Recovery Charge		–	1.1	–	μC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

4. Essentially independent of operating temperature typical characteristics.



TYPICAL PERFORMANCE CHARACTERISTICS

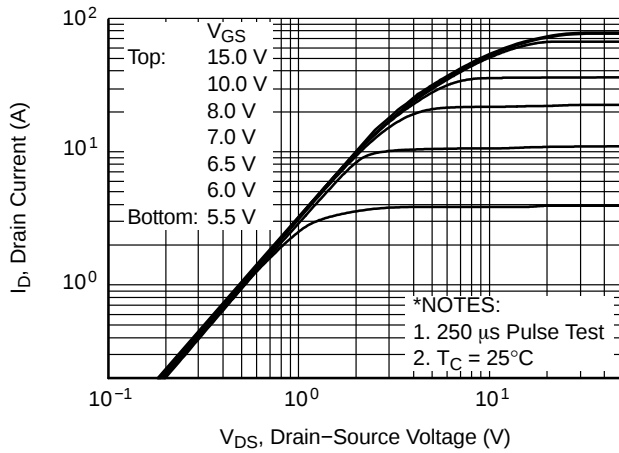


Figure 1. On-Region Characteristics

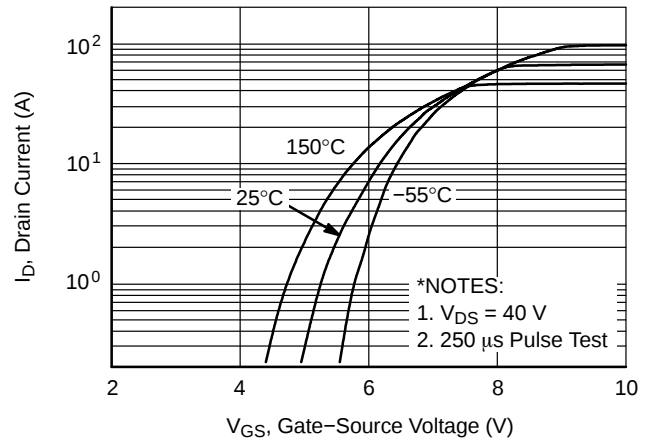


Figure 2. Transfer Characteristics

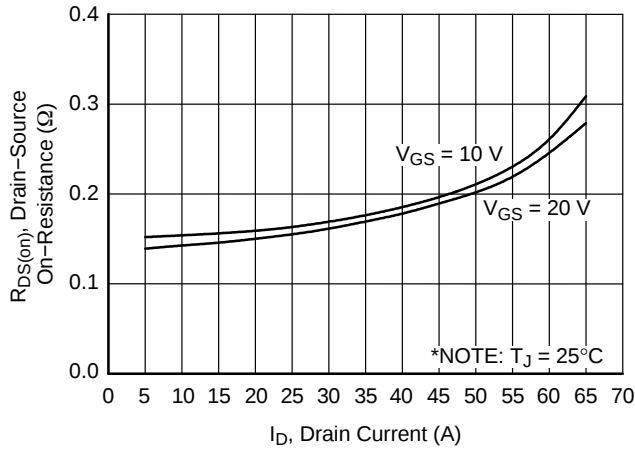


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

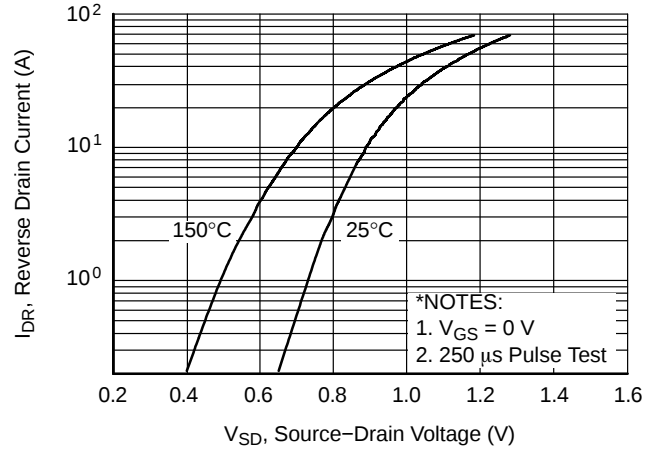


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

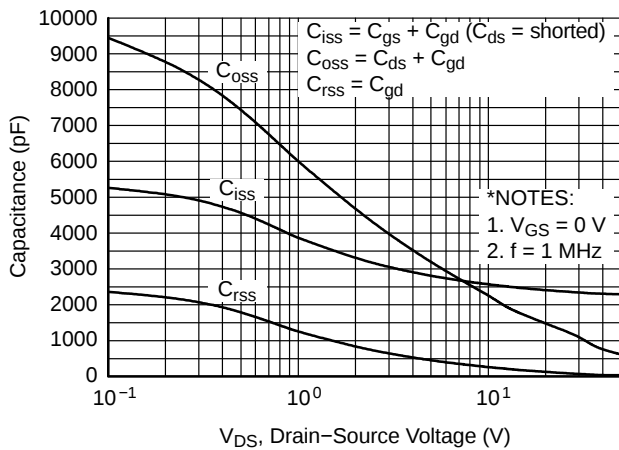


Figure 5. Capacitance Characteristics

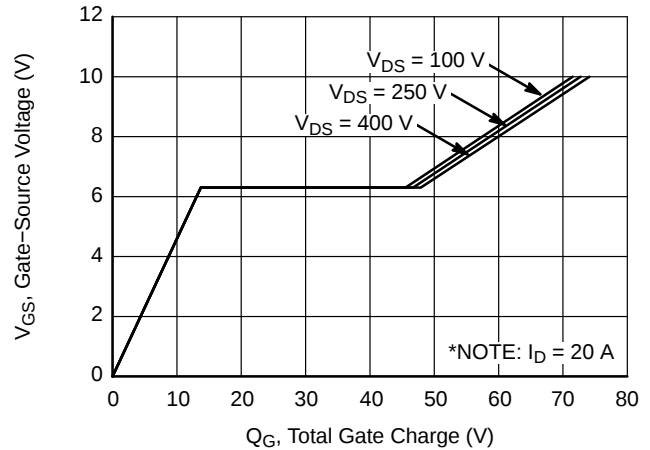


Figure 6. Gate Charge Characteristics

TYPICAL PERFORMANCE CHARACTERISTICS (CONTINUED)

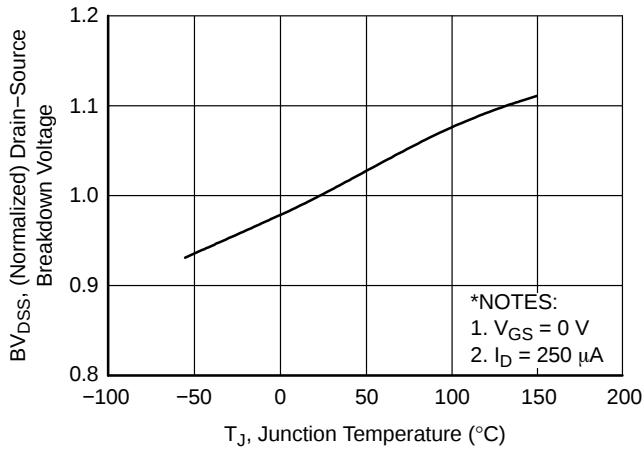


Figure 7. Breakdown Voltage Variation vs. Temperature

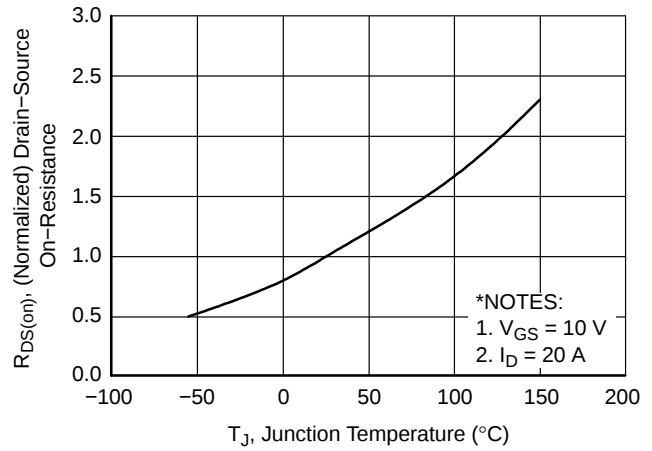


Figure 8. On-Resistance Variation vs. Temperature

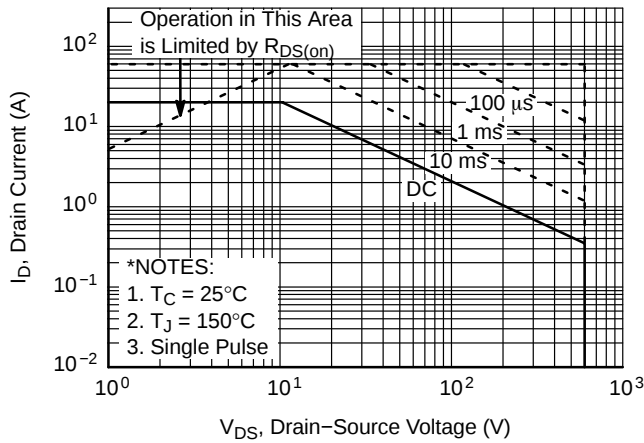


Figure 9. Maximum Safe Operating Area

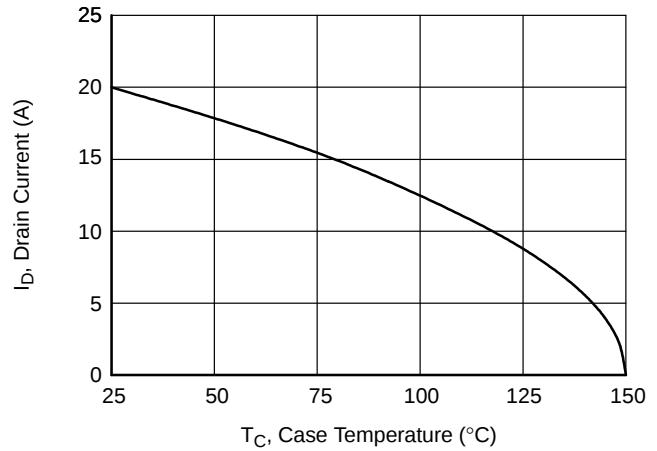


Figure 10. Maximum Drain Current vs. Case Temperature

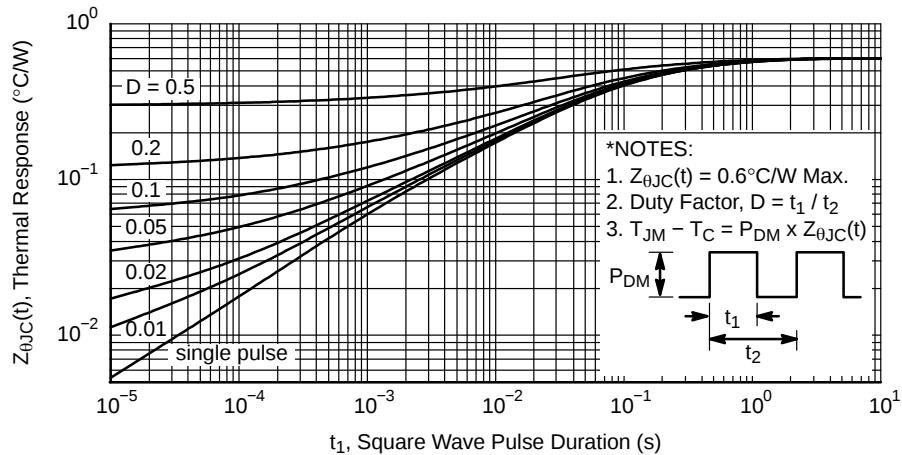


Figure 11. Transient Thermal Response Curve

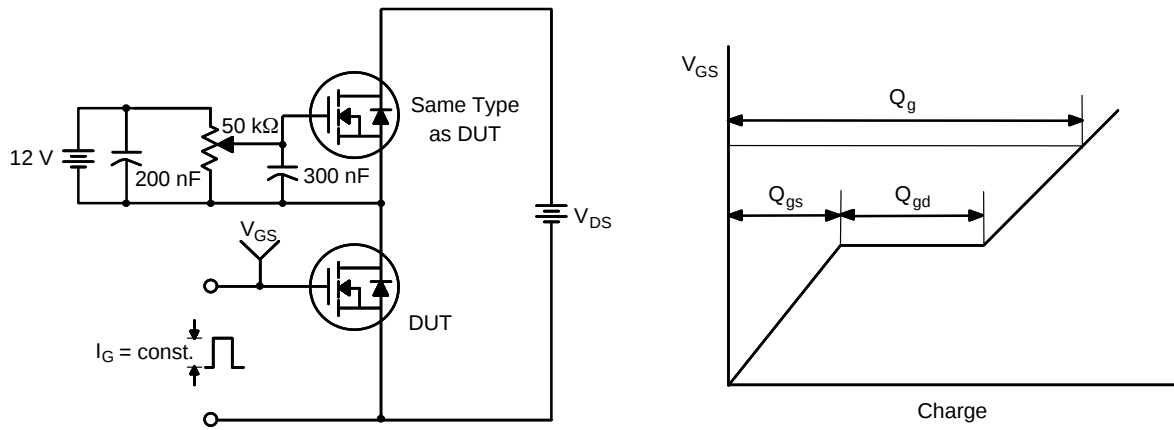


Figure 12. Gate Charge Test Circuit & Waveform

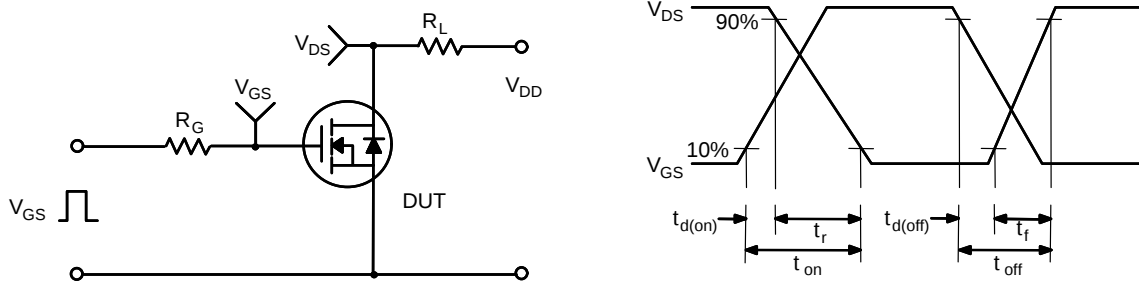


Figure 13. Resistive Switching Test Circuit & Waveforms

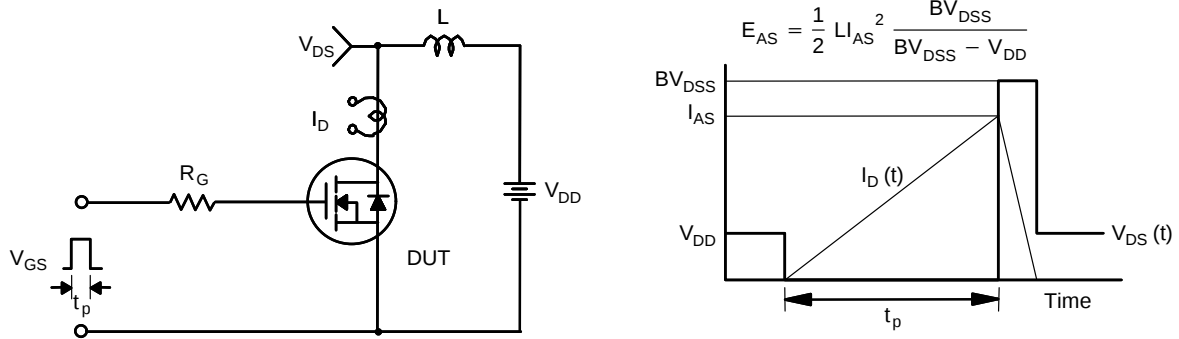


Figure 14. Unclamped Inductive Switching Test Circuit & Waveforms

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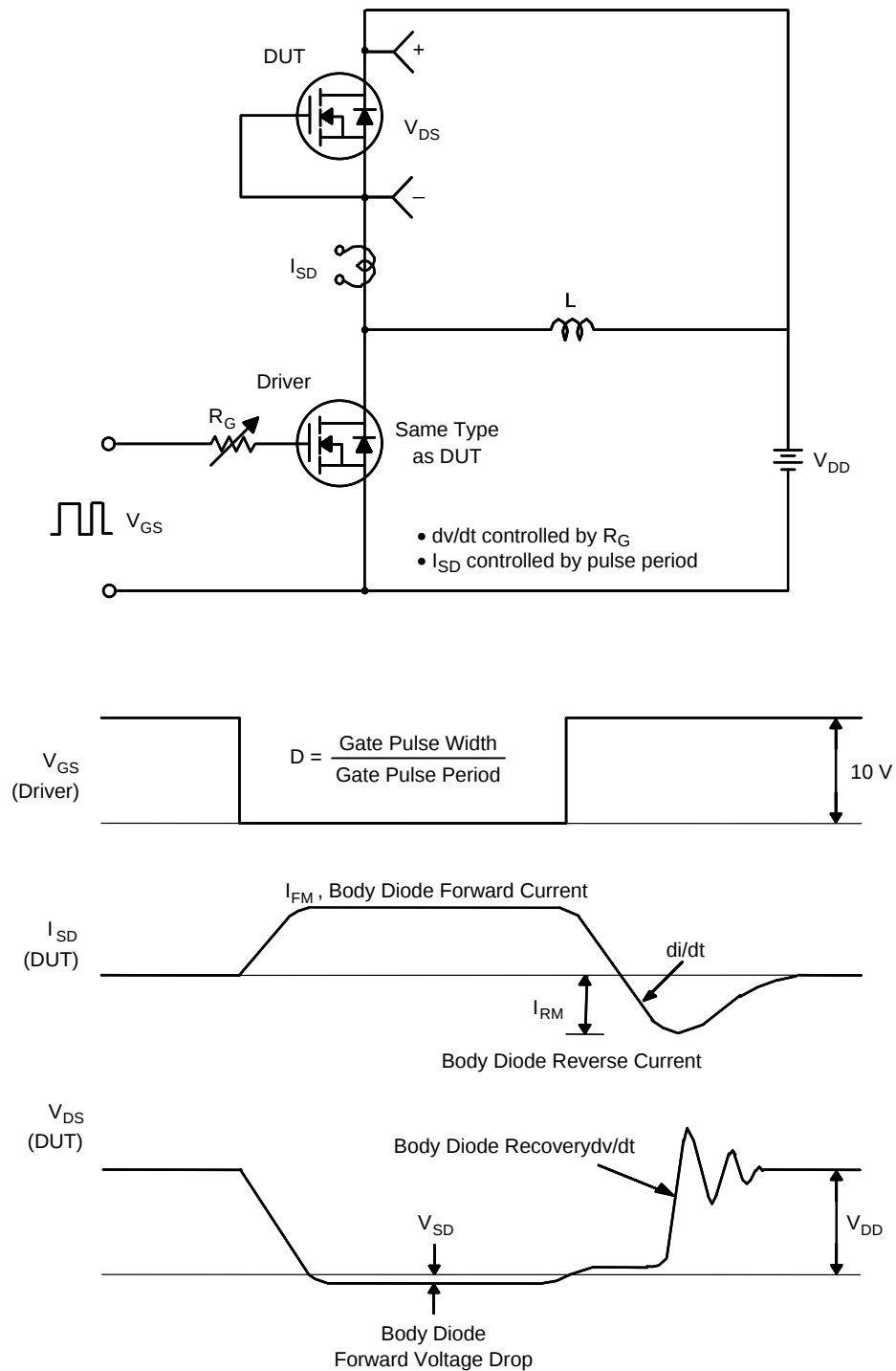
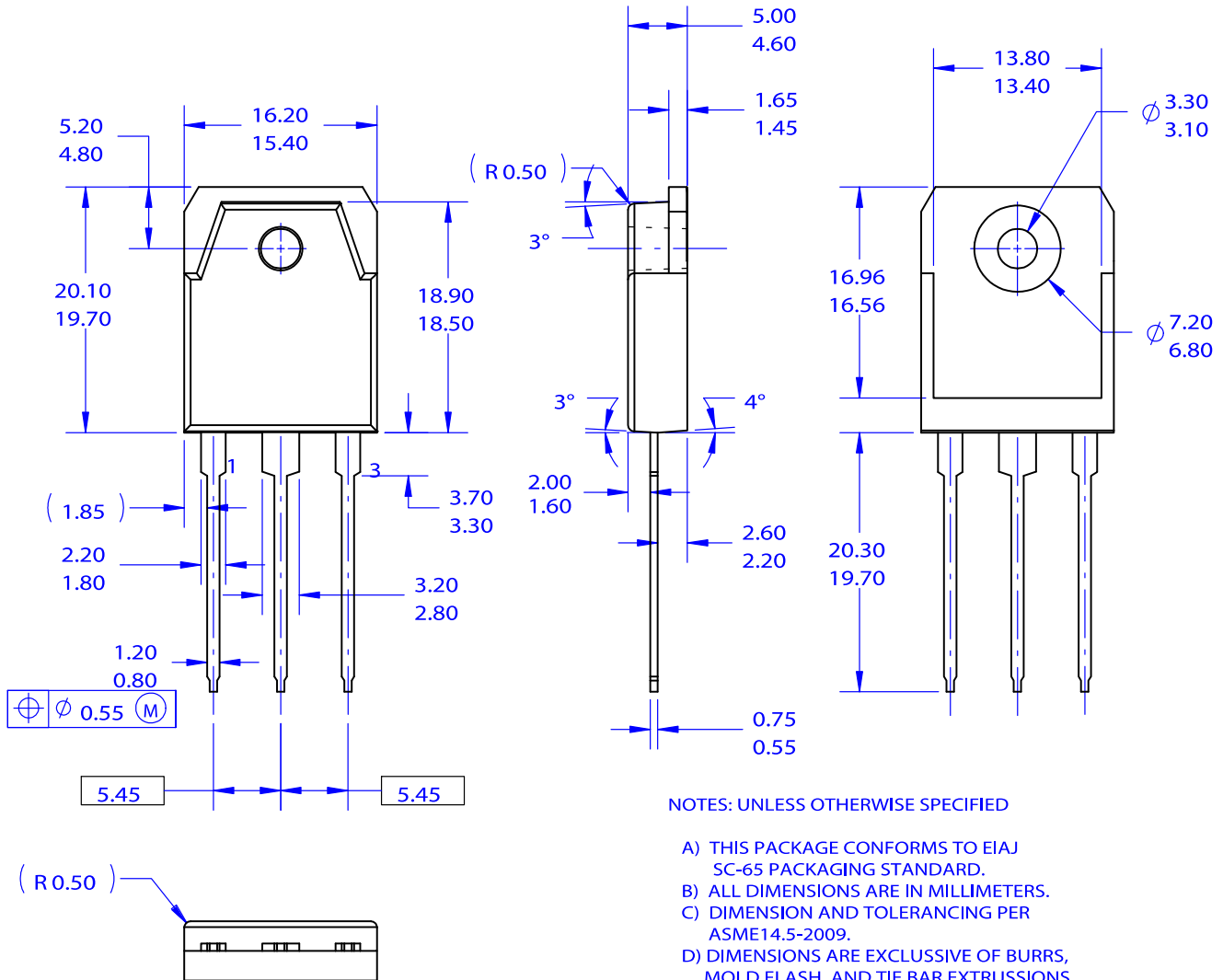


Figure 15. Peak Diode Recovery dv/dt Test Circuit & Waveforms

TO-3P-3LD / EIAJ SC-65, ISOLATED
CASE 340BZ
ISSUE O

DATE 31 OCT 2016



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